

Serial No. 09/857,553

Filed: June 5, 2001

Claim 1. (currently amended) A radiation sensitive composition comprising a resin composition and a radiation sensitive material, wherein the resin composition comprises two or more kinds of resins of (a) an alkali-soluble novolak resin and (b) a resin additive ~~comprising at least one member~~ selected from the group consisting of polyacrylic ester, polymethacrylic ester, polystyrene derivatives, polyvinyl benzoate, polyvinyl phenyl acetate, polyvinyl acetate, polyvinyl chloroacetate, polyacrylonitrile, poly- $\alpha$ -methylacrylonitrile, polyvinyl phthalimide, and copolymers obtained from two or more monomers selected from acrylic ester, methacrylic ester, styrene derivatives, vinyl benzoate, vinyl phenyl acetate, vinyl acetate, vinyl chloroacetate, acrylonitrile,  $\alpha$ -methylacrylonitrile, N-vinyl phthalimide, N-vinyl imidazole, N-vinyl carbazole, 2-vinyl quinoline, vinyl cyclohexane, vinyl naphthalene, vinyl pyridine and N-vinyl pyrrolidone, wherein polyacrylic ester of a resin additive is one member selected from the group of polymethyl acrylate, polyethyl acrylate, poly-n-propyl acrylate, poly-n-butyl acrylate, poly-n-hexyl acrylate, polyisopropyl acrylate, polyisobutyl acrylate, poly-t-butyl acrylate, polycyclohexyl acrylate, polybenzyl acrylate, poly-2-chloroethyl acrylate, polymethyl- $\alpha$ -chloroacrylate, polyphenyl  $\alpha$ -bromoacrylate or a copolymer therefrom, and polymethacrylic ester of a resin additive is one member selected from the group of polymethyl methacrylate, polyethyl methacrylate, poly-n-propyl methacrylate, poly-n-butyl methacrylate, poly-n-hexyl methacrylate, polyisopropyl methacrylate, polyisobutyl methacrylate, poly-t-butyl methacrylate, polycyclohexyl methacrylate, polybenzyl methacrylate, polyphenyl methacrylate, poly-1-phenylethyl methacrylate, poly-2-phenylethyl methacrylate, polyfurfuryl methacrylate, polydiphenylmethyl methacrylate, polypentachlorophenyl methacrylate, polynaphthyl methacrylate or a copolymer therefrom.

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Claim 2. (canceled)

Claim 3. (currently amended) A radiation sensitive composition comprising a resin composition and a radiation sensitive material, wherein the resin composition comprises at least (a) an alkali-soluble novolak resin and (b) a resin additive ~~comprising at least one member~~ selected from the group consisting of polyacrylic ester, polymethacrylic ester, polystyrene derivatives, polyvinyl benzoate, polyvinyl phenyl acetate, polyvinyl acetate, polyvinyl chloroacetate, polyacrylonitrile, poly- $\alpha$ -methylacrylonitrile, polyvinyl phthalimide, and copolymers obtained from two or more monomers selected from acrylic ester, methacrylic ester, styrene derivatives, vinyl benzoate, vinyl phenyl acetate, vinyl acetate, vinyl chloroacetate, acrylonitrile,  $\alpha$ -methylacrylonitrile, N-vinyl phthalimide, N-vinyl imidazole, N-vinyl carbazole, 2-vinyl quinoline, vinyl cyclohexane, vinyl naphthalene, vinyl pyridine and N-vinyl pyrrolidone, wherein polyacrylic ester of a resin additive is one member selected from the group of polymethyl acrylate, polyethyl acrylate, poly-n-propyl acrylate, poly-n-butyl acrylate, poly-n-hexyl acrylate, polyisopropyl acrylate, polyisobutyl acrylate, poly-t-butyl acrylate, polycyclohexyl acrylate, polybenzyl acrylate, poly-2-chloroethyl acrylate, polymethyl- $\alpha$ -chloroacrylate, polyphenyl  $\alpha$ -bromoacrylate or a copolymer therefrom and polymethacrylic ester of a resin additive is one member selected from the group of polymethyl methacrylate, polyethyl methacrylate, poly-n-propyl methacrylate, poly-n-butyl methacrylate, poly-n-hexyl methacrylate, polyisopropyl methacrylate, polyisobutyl methacrylate, poly-t-butyl methacrylate, polycyclohexyl methacrylate, polybenzyl methacrylate, polyphenyl methacrylate, poly-1-phenylethyl methacrylate, poly-2-phenylethyl methacrylate, polyfurfuryl methacrylate, polydiphenylmethyl methacrylate, polypentachlorophenyl methacrylate, polynaphthyl methacrylate or a copolymer therefrom and the radiation sensitive material is (c) a radiation sensitive material containing a quinonediazide group.

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**Claim 4. (previously presented)** The radiation sensitive composition according to claim 1, wherein the resin additive is a copolymer obtained from at least two monomers selected from acrylic esters, methacrylic esters and styrene derivatives, and a copolymer obtained from at least one of these monomers and an organic acid monomer having a carboxyl group or a carboxylic anhydride group.

**Claim 5. (original)** The radiation sensitive composition according to claim 4, wherein a copolymer obtained from at least one monomer selected from acrylic esters, methacrylic esters and styrene derivatives and an organic acid monomer having a carboxyl group or a carboxylic anhydride group has an acid value of 1 to 80 mg KOH/g.

**Claim 6. (original)** The radiation sensitive composition according to claim 4, further comprising a polymer-containing 50 mole-% or more of a repeating unit having a carboxyl group or a carboxylic anhydride group.

**Claim 7. (previously presented)** The radiation sensitive composition according to claim 1, wherein the dissolution rate in 2.38 weight-% aqueous tetramethylammonium hydroxide of the radiation sensitive composition is not more than 5000 Å/min.

**Claim 8. (previously presented)** The radiation sensitive composition according to claim 1, wherein when the resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the weight average molecular weight of the resin is 7,000 to 20,000 as determined by polystyrene standards and when the resin containing styrene derivative-repeating units of not less than 50 mole-% of repeating units in the resin is used as the resin additive, the weight

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average molecular weight of the resin is 3,000 to 25,000 as determined by polystyrene standards.

Claim 9. (original) The radiation sensitive composition according to claim 4, wherein the value of X which is  $B/A$  is in the range of 0.01 to 0.13 whereupon A is an integrated area beneath peaks in the range of 7.2 to 5.6 ppm and B is an integrated area beneath peaks in the range of 1.3 to 0.95 ppm in a H-NMR spectrum of a solution of the resin composition in heavy acetone.

Claim 10 (canceled)

Claim 11. (previously presented) The radiation sensitive composition according to claim 1, wherein the weight average molecular weight of the novolak resin is 3,000 to 15,000 as determined by polystyrene standards.

Claim 12. (original) The radiation sensitive composition according to claim 1 or 3, wherein when a resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the amount of the radiation sensitive material is 1 to 20 parts by weight relative to 100 parts by weight of the alkali-soluble resin in the radiation sensitive composition and when a resin containing styrenic monomer-repeating units of not less than 50 mole-% of repeating units in the resin is used as the resin additive, the amount of the radiation sensitive material is 10 to 30 parts by weight relative to 100 parts by weight of the alkali-soluble resin in the radiation sensitive composition.

Claim 13. (original) The radiation sensitive composition according to claim 12, wherein

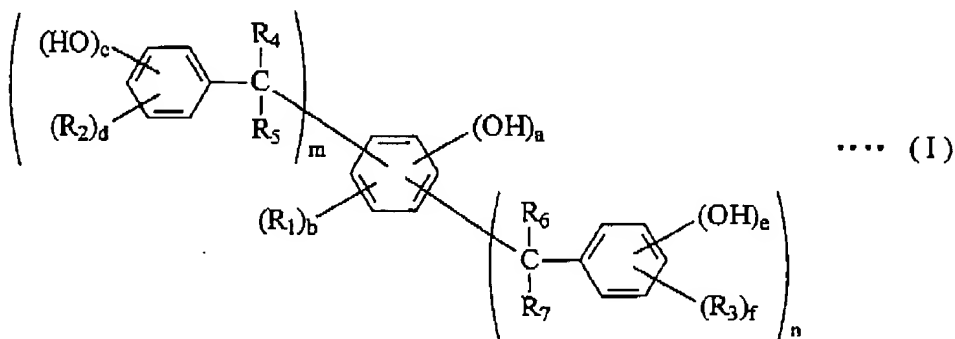
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when the resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the amount of the radiation sensitive material is 1 to 18 parts by weight relative to 100 parts by weight of the alkali-soluble resin in the radiation sensitive composition.

Claim 14. (previously presented) The radiation sensitive composition according to claim 1, wherein when a resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the content of the resin additive is 1 to 20 parts by weight relative to 100 parts by weight of novolak resin of the alkali-soluble resin and when a resin containing styrenic monomer-repeating units of not less than 50 mole-% of repeating units in the resin is used as the resin additive, the content of the resin additive is 0.5 to 5 parts by weight relative to 100 parts by weight of novolak resin of the alkali-soluble resin.

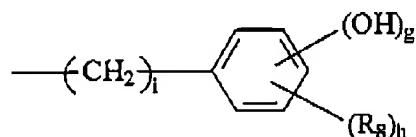
Claim 15. (original) The radiation sensitive composition according to claim 1, further comprising a low molecular compound having phenolic hydroxyl group or groups represented by the general formula (I):



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wherein  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $R_6$  and  $R_7$  each represents independently H, a  $C_1$  to  $C_4$  alkyl group, a  $C_1$  to  $C_4$  alkoxy group, a cyclohexyl group or a group represented by the formula:



wherein  $R_8$  represents H, a  $C_1$  to  $C_4$  alkyl group, a  $C_1$  to  $C_4$  alkoxy group or a cyclohexyl group; each of  $m$  and  $n$  is 0, 1 or 2; each of  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $e$ ,  $f$ ,  $g$  and  $h$  is 0 or an integer of 1 to 5 satisfying  $a + b \leq 5$ ,  $c + d \leq 5$ ,  $e + f \leq 5$ , and  $g + h \leq 5$ ; and  $i$  is 0, 1 or 2.

Claim 16. (previously presented) The radiation sensitive composition according to claim 3, wherein the resin additive is a copolymer obtained from at least two monomers selected from acrylic esters, methacrylic esters and styrene derivatives, and a copolymer obtained from at least one of these monomers and an organic acid monomer having a carboxyl group or a carboxylic anhydride group.

Claim 17. (previously presented) The radiation sensitive composition according to claim 16, wherein a copolymer obtained from at least one monomer selected from acrylic esters, methacrylic esters and styrene derivatives and an organic acid monomer having a carboxyl group or a carboxylic anhydride group has an acid value of 1 to 80 mg KOH/g.

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Claim 18. (previously presented) The radiation sensitive composition according to claim 16, further comprising a polymer-containing 50 mole-% or more of a repeating unit having a carboxyl group or a carboxylic anhydride group.

Claim 19. (previously presented) The radiation sensitive composition according to claim 3, wherein the dissolution rate in 2.38 weight-% aqueous tetramethylammonium hydroxide of the radiation sensitive composition is not more than 5000 Å/min.

Claim 20. (previously presented) The radiation sensitive composition according to claim 3, wherein when the resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the weight average molecular weight of the resin is 7,000 to 20,000 as determined by polystyrene standards and when the resin containing styrene derivative-repeating units of not less than 50 mole-% of repeating units in the resin is used as the resin additive, the weight average molecular weight of the resin is 3,000 to 25,000 as determined by polystyrene standards.

Claim 21. (previously presented) The radiation sensitive composition according to claim 16, wherein the value of X which is B/A is in the range of 0.01 to 0.13 whereupon A is an integrated area beneath peaks in the range of 7.2 to 5.6 ppm and B is an integrated area beneath peaks in the range of 1.3 to 0.95 ppm in a  $^1\text{H}$ -NMR spectrum of a solution of the resin composition in heavy acetone.

Claim 22. (previously presented) The radiation sensitive composition according to claim 3, wherein the weight average molecular weight of the novolak resin is 3,000 to

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15,000 as determined by polystyrene standards.

Claim 23. (previously presented) The radiation sensitive composition according to claim 3, wherein when a resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the amount of the radiation sensitive material is 1 to 20 parts by weight relative to 100 parts by weight of the alkali-soluble resin in the radiation sensitive composition and when a resin containing styrenic monomer-repeating units of not less than 50 mole-% of repeating units in the resin is used as the resin additive, the amount of the radiation sensitive material is 10 to 30 parts by weight relative to 100 parts by weight of the alkali-soluble resin in the radiation sensitive composition.

Claim 24. (previously presented) The radiation sensitive composition according to claim 23, wherein when the resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the amount of the radiation sensitive material is 1 to 18 parts by weight relative to 100 parts by weight of the alkali-soluble resin in the radiation sensitive composition.

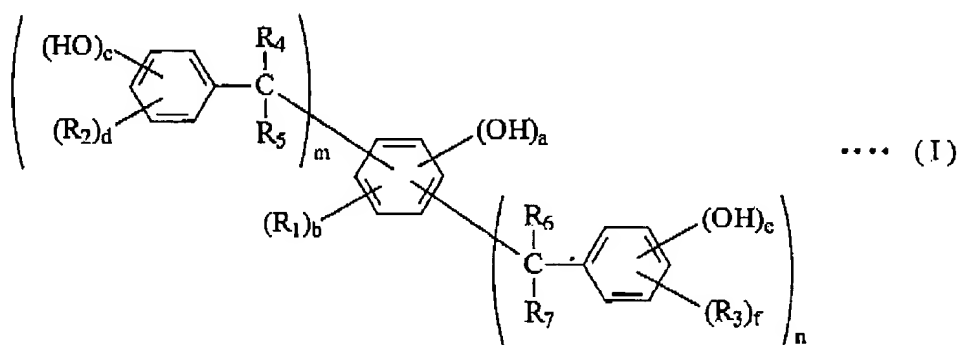
Claim 25. (previously presented) The radiation sensitive composition according to claim 3, wherein when a resin containing styrenic monomer-repeating units of less than 50 mole-% of repeating units in the resin is used as the resin additive, the content of the resin additive is 1 to 20 parts by weight relative to 100 parts by weight of novolak resin of the alkali-soluble resin and when a resin containing styrenic monomer-repeating units of not less than 50 mole-% of repeating units in the resin is used as the resin additive, the content of the resin additive is 0.5 to 5 parts by weight relative to 100 parts by weight of novolak resin of the alkali-soluble resin.



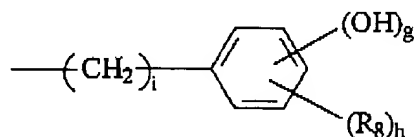
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Claim 26. (previously presented) The radiation sensitive composition according to claim 3, further comprising a low molecular compound having phenolic hydroxyl group or groups represented by the general formula (I):



wherein  $R_1$ ,  $R_2$ ,  $R_3$ ,  $R_4$ ,  $R_5$ ,  $R_6$  and  $R_7$  each represents independently H, a  $C_1$  to  $C_4$  alkyl group, a  $C_1$  to  $C_4$  alkoxy group, a cyclohexyl group or a group represented by the formula:



wherein  $R_8$  represents H, a  $C_1$  to  $C_4$  alkyl group, a  $C_1$  to  $C_4$  alkoxy group or a cyclohexyl group; each of  $m$  and  $n$  is 0, 1 or 2; each of  $a$ ,  $b$ ,  $c$ ,  $d$ ,  $e$ ,  $f$ ,  $g$  and  $h$  is 0 or an integer of 1 to 5 satisfying  $a + b \leq 5$ ,  $c + d \leq 5$ ,  $e + f \leq 5$ , and  $g + h \leq 5$ ; and  $i$  is 0, 1 or 2.